Penn State University
PROGNOSIS RESEARCH

Penn State University possesses full testing and analytical capabilities to accomplish system prognosis:

- Drivetrain Center
- Gear Research Institute (affiliated with ASME and AGMA)
- Rotorcraft Center of Excellence
- Materials Research Institute
- Life Prediction / Reliability
- Signal Processing
- Modeling and Simulation
- Tribology
- Partnerships with Industry

Gear Systems Dynamic Modeling

- Full analytical models and physical understanding of meshing action of spur, helical, and bevel gears.

- Very accurate finite-element model of tooth / gearbody stiffnesses.

- Full dynamics modeling capability including discrete and continuous parameter system elements.

- Computations of gear-meshing excitations and dynamic response spectra verified by experimental comparison with excellent agreement.

Real-Time Sub-Critical Gear Flaw Detection and Prognosis

- Develop full physical quantitative understanding of detectable flaw characteristics and their progression – e.g., tooth-root/gearbody cracks and surface (pitting) flaws – by both dedicated gear testing and analysis.

- Incorporate "deconvolution" associated with meshing action of spur, helical, and bevel gears.

- Develop and incorporate optimum signal processing from single and multiple sensors to minimize missed detections and false alarms, and for prediction of remaining useful life.

Experimental Facilities and Implementations
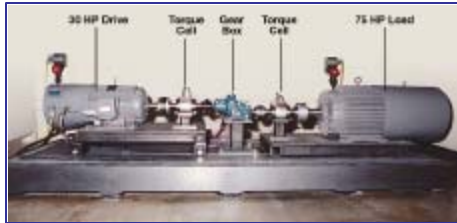
Mechanical Diagnostics

System Integration
and Testing

Battery Diagnostics

Lubrication Systems

Gear Single Tooth
Bending Fatigue

Data Fusion

Torsional Vibration

Power Circulating
Gear Fatigue

Prognostic Reasoning and Data Fusion

- Contextual information fusion and prognostic reasoning for aircrew, maintainers, mission planners – capability and impact assessment

- Hybrid reasoning and cognitive agents for robustness in real-world situations and new environments

- Adaptive distributed real-time information management tools for hierarchical multi-user situations – consistency and reconfigurability